January 12, 2007

Mr. Christopher M. Crane
President and Chief Nuclear Officer
Exelon Nuclear
Exelon Generation Company, LLC
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: BYRON STATION, UNITS 1 AND 2
NRC COMPONENT DESIGN BASES INSPECTION (CDBI)
REPORT 05000454/2006009; 05000455/2006009(DRS)

Dear Mr. Crane:

On December 1, 2006, the U.S. Nuclear Regulatory Commission (NRC) completed a baseline inspection at your Byron Station. The enclosed report documents the inspection findings which were discussed on December 1, 2006, with Mr. D. Hoots and other members of your staff.

The inspection examined activities conducted under your license, as they relate to safety, and to compliance with the Commission's rules and regulations, and with the conditions of your license. The inspectors reviewed selected procedures and records, observed activities, and interviewed personnel. Specifically, this inspection focused on the design of components that are risk significant and have low design margin.

Based on the results of this inspection, two NRC-identified findings of very low safety significance, which involved violations of NRC requirements were identified. However, because these violations were of very low safety significance, and because they were entered into your corrective action program, the NRC is treating the issues as Non-Cited Violations (NCVs) in accordance with Section VI.A.1 of the NRC's Enforcement Policy. Additionally, a licensee identified violation is listed in Section 4OA7 of this report.

If you contest the subject or severity of a Non-Cited Violation, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with a copy to the Regional Administrator, U.S. Nuclear Regulatory Commission - Region III, 2443 Warrenville Road, Suite 210, Lisle, IL 60532-4352; the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; and the Resident Inspector Office at the Byron Station.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any), will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS), accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA/

Ann Marie Stone, Chief
Engineering Branch 2
Division of Reactor Safety

Docket Nos. 50-454; 50-455
License Nos. NPF-37; NPF-66

Enclosure: Inspection Report 05000454/2006009; 05000455/2006009(DRS)
w/Attachment: Supplemental Information

cc w/encl: Site Vice President - Byron Station
Plant Manager - Byron Station
Regulatory Assurance Manager - Byron Station
Chief Operating Officer
Senior Vice President - Nuclear Services
Vice President - Mid-West Operations Support
Vice President - Licensing and Regulatory Affairs
Director Licensing
Manager Licensing - Braidwood and Byron
Senior Counsel, Nuclear
Document Control Desk - Licensing
Assistant Attorney General
Illinois Emergency Management Agency
State Liaison Officer, State of Illinois
State Liaison Officer, State of Wisconsin
Chairman, Illinois Commerce Commission
B. Quigley, Byron Station

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Vice President - Licensing and Regulatory Affairs
Director Licensing
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U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket No:	50-454; 50-455
License Nos.	NPF-37; NPF-66
Report No:	05000454/2006009; 05000455/2006009(DRS)
Licensee:	Exelon Nuclear
Facility:	Byron Station, Units 1 and 2
Location:	Byron, IL
Dates:	October 30, 2006, through December 1, 2006
Inspectors:	J. Jacobson, Senior Reactor Engineer, Lead Inspector G. Hausman, Senior Reactor Engineer C. Acosta, Reactor Engineer L. Kozak, Senior Reactor Analyst C. Moore, Senior Operations Inspector J. Leivo, Electrical Contractor H. Campbell, Mechanical Contractor
Approved by:	Ann Marie Stone, Chief Engineering Branch 2 Division of Reactor Safety

Enclosure

SUMMARY OF FINDINGS

IR 05000454/2006009; 05000455/2006009(DRS); 10/30/2006 - 12/01/2006; Byron Station; Component Design Bases Inspection.

The inspection was a 3-week onsite baseline inspection that focused on the design of components that are risk significant and have low design margin. The inspection was conducted by four regional inspectors and two consultants. Two Green Non-Cited Violations (NCVs) were identified. The significance of most findings are indicated by their color (Green, White, Yellow, Red) using Inspection Manual Chapter 0609, "Significance Determination Process (SDP)." Findings for which the SDP does not apply may be Green, or be assigned a severity level after NRC management review. The NRC's program for overseeing the safe operation of commercial nuclear power reactors, is described in NUREG-1649, "Reactor Oversight Process," Revision 3, dated July 2000.

A. Inspector-Identified and Self-Revealed Findings

Cornerstone: Mitigating Systems

- Green. The team identified a NCV of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," having very low safety significance. The power uprate electrical loading calculation used incorrect design input for the 4160 Vac engineered safety features (ESF) distribution system load analysis. Specifically, the licensee's contract engineering organization failed to adequately verify design input data used to determine brake horsepower loading. The incorrect horsepower values were subsequently used in revising the 4160 Vac ESF distribution system power analysis. The licensee's acceptance review did not identify the problem. Using corrected values, the licensee determined that the reduction in load margin was acceptable based on a revised loading calculation prepared informally during the inspection.

  The finding was more than minor because failing to correctly identify, verify, and input the correct design data into the electrical power analysis program resulted in the load conditions not being adequately evaluated, resulting in inaccurate and non-conservative determination of loading and load margin for the 4160 Vac ESF buses. The finding was of very low safety significance based on the results of the licensee's analysis and screened as Green using the SDP Phase 1 screening worksheet. (Section 1R21.3.b.1)

- Green. The team identified a NCV of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," having very low safety significance. Specifically, the calculation for evaluating the net positive suction head (NPSH) for the safety injection pump contained errors and failed to demonstrate that the acceptance criteria was met. To demonstrate operability, the licensee performed a preliminary calculation, using a less conservative pump flow value.

  The finding was more than minor because the calculation of record was not adequate and failed to demonstrate that the NPSH available met design basis requirements. The finding was of very low safety significance based on the results of the licensee's corrected analysis and screened as Green using the SDP Phase 1 screening

worksheet. The cause of the finding was related to the cross-cutting aspect of human performance. (Section 1R21.3.b.2)

B. Licensee-Identified Violations

A violation of very low safety significance, which was identified by the licensee has been reviewed by the inspectors. Corrective actions taken or planned by the licensee have been entered into the licensee's corrective action program. This violation and the licensee's corrective action tracking numbers are listed in Section 4OA7 of this report.

REPORT DETAILS

1. REACTOR SAFETY

Cornerstone: Initiating Events, Mitigating Systems, and Barrier Integrity

1R21 Component Design Bases Inspection (71111.21)

.1 Introduction

The objective of the component design bases inspection is to verify that design bases have been correctly implemented for the selected risk significant components and that operating procedures and operator actions are consistent with design and licensing bases. As plants age, their design bases may be difficult to determine, and an important design feature may be altered or disabled during a modification. The Probabilistic Risk Assessment (PRA) model assumes the capability of safety systems and components to perform their intended safety function successfully. This inspectible area verifies aspects of the initiating events, mitigating systems, and barrier integrity cornerstones, for which there are no indicators to measure performance. Specific documents reviewed during the inspection are listed in the attachment to the report.

.2 Inspection Sample Selection Process

The inspectors selected risk significant components and operator actions for review using information contained in the licensee's PRA. The operator actions selected for review included actions taken by operators both inside and outside of the control room during postulated accident scenarios.

The inspectors performed a margin assessment and detailed review of the selected risk-significant components to verify that the design bases have been correctly implemented and maintained. This assessment considered operational, maintenance, and calculated design margin. Recent operations procedure changes as well as manual operator actions were considered for operational margin. Equipment reliability issues were also considered in the selection of components for detailed review. These included items such as failed performance test results, significant corrective action, repeated maintenance activities, maintenance rule (a)(1) status, components requiring an operability evaluation, NRC resident inspector input of problem equipment, system health reports, and the potential margin issues list. Consideration was also given to the uniqueness and complexity of the design, operating experience, and the available defense in depth margins. As practical, the inspectors performed walkdowns of the components to evaluate the as-built design and material condition. A summary of the reviews performed and the specific inspection findings identified are included in the following sections of the report.

.3 Component Design

a. Inspection Scope

The inspectors reviewed the Final Safety Analysis Report (FSAR), Technical Specifications (TS), component/system design basis documents, drawings, and other available design basis information, to determine the performance requirements of the selected components. The inspectors used applicable industry standards, such as the American Society of Mechanical Engineers (ASME) Code, and the Institute of Electrical and Electronics Engineers (IEEE) Standards, to evaluate acceptability of the systems' design. The review was to verify that the selected components would function as required and support proper operation of the associated systems. The attributes that were needed for a component to perform its required function included process medium, energy sources, control systems, operator actions, and heat removal. The attributes to verify that the component condition and tested capability were consistent with the design bases and were appropriate included installed configuration, system operation, detailed design, system testing, equipment/environmental qualification, equipment protection, component inputs/outputs, operating experience, and component degradation.

For the components selected, the inspectors reviewed the maintenance history, system health report, and corrective action process documents. Walkdowns were conducted for all accessible components to assess material condition and to verify the as-built condition was consistent with the design. Other attributes reviewed were included as part of the scope for each individual component.

The components (16 samples) listed below were reviewed as part of this inspection effort:

- 125 Vdc Bus 111: For battery 111, the team selectively reviewed battery load calculations and margins; voltage drop to selected loads, including the 480 Vac switchgear control devices located in the essential cooling tower structure; battery capacity for design basis events; the last performance test; and a sample of battery surveillances. The team also reviewed the battery charger sizing calculation, test data and preventive maintenance. To assess the licensee's identification and disposition of adverse conditions, the team reviewed a sample of corrective action documents for the 125 Vdc system. The team also performed a visual non-intrusive inspection of observable portions of battery 111, DC distribution center 111, and charger 111 to assess the installation configuration, material condition, and potential vulnerability to hazards.

- Component Cooling Water (CCW) Pumps: The team interviewed the CCW system engineers with focus on the history and physical condition and testing of the pumps. The team ensured that design basis requirements were properly translated into testing/surveillance procedures. Following this assessment, the team reviewed a large sample of CCW pump work orders with the major emphasis on the ASME/IST test performance results. The team also reviewed associated electrical calculations to confirm that the design basis minimum voltage at the motor terminals would be adequate for starting and running the motor under design basis condition

- CCW Heat Exchangers: The CCW system engineer was interviewed with focus on the overall condition and testing of the heat exchangers. A sample of the Generic Letter 89-13 testing of the CCW heat exchangers was reviewed. The surveillance test thermal performance requirements were reviewed and found to be consistent with design requirements. Calculations addressing the Byron/Braidwood Uprate project and tube plugging evaluations were also reviewed.

- 4160 Vac Engineered Safety Features Bus 241: The team selectively reviewed one-line and schematic diagrams as well as calculations for electrical distribution system load flow, degraded voltage protection, and electrical protection. The team reviewed the adequacy and appropriateness of design assumptions and calculations to determine if the voltages at load terminals, under design basis motor starting and loading conditions, would remain above the minimum acceptable values. For the pump components in the team's sample, the team assessed the bases for brake horsepower (BHP) values used as design inputs to the licensee's load flow / electrical distribution system model, and the protective settings were reviewed to assess the adequacy of protection and preclusion of premature tripping under design basis conditions.

  The team also reviewed a sample of the latest preventive maintenance results for selected main, tie, and feeder circuit breakers, and selected operating experience associated with the switchgear. The team performed a visual non-intrusive inspection of observable portions of the safety-related 4160 Vac switchgear in both units, to assess the installation configuration, material condition, and potential vulnerability to hazards. The team selectively reviewed environmental qualification of protective relays for the elevated temperature transient expected in the switchgear room for a steam line break in the adjacent turbine building. The team also reviewed the calibration procedure for the degraded voltage relays and the latest calibration data sheets, to ensure that the relays were set in accordance with the calculation, and that the calibration procedures were consistent with the assumptions in the calculation.

- 4160 V/480 Vac Transformer 132X: The team reviewed the vendor documentation, design documents, and loading calculations that established the basis for the transformer ratings, to assess margins with respect to the ratings of the transformer and connecting cabling. The team also reviewed the results of the latest preventive maintenance performed on the transformer.

- Auxiliary Feedwater (AFW) Pump: The inspectors reviewed piping and instrumentation diagrams, pump line up, and pump capacities for both the diesel driven and motor driven AFWs. Also, the inspectors reviewed various analyses, procedures, and test results associated with operation of the AFW pumps under transient, accident, and station blackout conditions. The analyses included hydraulic performance, net positive suction head (NPSH), minimum flow and minimum required fuel quantity (for the diesel driven auxiliary feedwater pump). The inspectors also reviewed the pump low suction pressure trip control logic for PSL-AF051 and PSL-AF055 and associated EQ requirements. Design change

history was reviewed, to assess potential component degradation and impact on design margins. In service testing (IST) results were reviewed to verify acceptance criteria were met and performance degradation would be identified.

- 125 Vdc Molded Case Circuit Breakers: The team selected a sample of comparatively high risk 125 Vdc molded case circuit breakers (MCCBs), comprised of the main breaker, charger breaker, tie breaker, and inverter feeder breaker. The team selectively reviewed the calculations supporting the trip settings and protection coordination as well as the licensee's preventive maintenance template for the circuit breakers, results of the latest trip testing, and related preventive maintenance activities.

- Service Water Pumps: The inspectors reviewed piping and instrumentation diagrams, pump line up, pump capacities, and in-service testing. Design calculations related to pump head, flow, NPSH and pump's supporting components (i.e., pump lube oil and room cooler heat exchangers) were reviewed to ensure the pumps were capable of providing their accident mitigation function during all ambient conditions. Design change history was reviewed to assess potential component degradation and impact on design margins. The water supply (suction and discharge) path and the ultimate heat sink integrity during normal, extreme weather, and accident scenarios were reviewed to ensure that the water source design basis was maintained. The team also reviewed associated electrical calculations to confirm that the design basis minimum voltage at the motor terminals would be adequate for starting and running the motor under design basis conditions, and reviewed the latest preventive maintenance performed on the pump motors. The inspectors also reviewed the pump low suction pressure trip control logic for PSL-SX023 and PSL-SX024 and associated EQ requirements.

- Emergency Diesel Generator 1A: The inspection team interviewed the Emergency Diesel Generator (EDG) system engineer and discussed system performance and recent Issue Reports. A sample of EDG surveillances were reviewed, and the inspectors witnessed the performance of the 6-month surveillance of EDG 1B. In addition the EDG push rod failure operability evaluations and concerns were discussed and reviewed. Calculations addressing fuel consumption and tank volumes were also reviewed. Further, the inspectors reviewed EDG room heat-up calculations to verify adequate cooling. The team also selectively reviewed the calculations supporting electrical loading of the emergency diesel generator for station blackout conditions.

- Residual Heat Removal (RHR) Pumps: The team interviewed the RHR system engineers, both current and previous, with focus on the history and physical condition and testing of the RHR pumps. The team ensured that design basis requirements were properly translated into testing/surveillance procedures. Following this assessment, the team reviewed a large sample of RHR pump work orders with the major emphasis on the ASME/IST test performance results. Attention was given to test instrumentation and the associated uncertainty calculations. Further, the team reviewed required NPSH and vortex-related

calculations. The team also reviewed associated electrical calculations to confirm that the design basis minimum voltage at the motor terminals would be adequate for starting and running the motor under design basis conditions.

- RWST Level Instrumentation: The inspectors performed a walkdown of the RWST, reviewed the design of the level instrumentation including subsequent modifications, reviewed associated EQ and Regulatory Guide 1.97 requirements, and reviewed the logic circuits for automatic switch-over from the injection path to the recirculation flow path. The inspectors also reviewed the basis and determination of the instrumentation setpoints. In addition, the inspectors reviewed tank and installation drawings, instrument scaling and uncertainty calculations, and interfaces with mechanical calculations, to determine the adequacy of the existing setpoints, including allowance for vortexing or other process effects. The inspectors reviewed calibration procedures for the instrument loops to confirm that the range, scaling, accuracy and setpoints were consistent with the design and licensing bases, including consistency with the assumptions in the uncertainty calculations.

- Condensate Storage Tank (CST) Level Instrumentation: The inspectors performed a walkdown of the CST, reviewed the design of the level instrumentation, reviewed associated EQ and Regulatory Guide 1.97 requirements. The inspectors also reviewed the basis and determination of the instrumentation setpoints. In addition, the inspectors reviewed tank and installation drawings, instrument scaling and uncertainty calculations, and interfaces with mechanical calculations, to determine the adequacy of the existing setpoints, including allowance for vortexing or other process effects. The inspectors reviewed calibration procedures for the instrument loops to confirm that the range, scaling, accuracy and setpoints were consistent with the design and licensing bases, including consistency with the assumptions in the uncertainty calculations.

- RHR Heat Exchangers: The team interviewed the RHR system engineers, with focus on the history and physical condition and testing of the RHR heat exchangers. The team reviewed design documents to ensure the design requirements for the power uprate were adequately addressed. The team ensured that design basis requirements were properly translated into operating procedures.

- Containment Sump Isolation Valves: The team reviewed the motor-operated valve (MOV) calculations for 1SI8811A/B and 2SI8811A/B, including required thrust, and maximum differential pressure, to ensure the valve was capable of functioning under design conditions. Periodic Verification Diagnostic and IST results were reviewed to verify acceptance criteria were met and performance degradation would be identified. Associated electrical calculations were reviewed to confirm that the design basis minimum voltage at the MOV motor terminals was consistent with the design inputs used in the MOV thrust calculations, and that the thermal overload heaters protecting the motors would not prematurely trip. The team also reviewed the results of the last test of the

thermal overload devices. The team also reviewed the control logic schematic diagrams, the system description, and flow control diagrams to verify the adequacy of valve control logic design and to ensure that the valve was capable of functioning under design conditions. Associated EQ requirements were reviewed to verify current qualification.

- Containment Spray Pump Suction Valves: The team reviewed the motor-operated valve (MOV) calculations for 1CS001A/B and 2CS001A/B, including required thrust, and maximum differential pressure, to ensure the valve was capable of functioning under design conditions. Periodic Verification Diagnostic and IST results were reviewed to verify acceptance criteria were met and performance degradation would be identified. Associated electrical calculations were reviewed to confirm that the design basis minimum voltage at the MOV motor terminals was consistent with the design inputs used in the MOV thrust calculations, and that the thermal overload heaters protecting the motors would not prematurely trip. The team also reviewed the results of the last test of the thermal overload devices. The team also reviewed the control logic schematic diagrams, the system description, and flow control diagrams to verify the adequacy of valve control logic design and to ensure that the valve was capable of functioning under design conditions. Associated EQ requirements were reviewed to verify current qualification.

- Chemical and Volume Control Pump: The team reviewed design calculations to ensure that the pump's design requirements were properly determined, (e.g., pump pressures and flows and required NPSH), The team ensured that design basis requirements were correctly translated into test acceptance criteria. The team reviewed completed tests to ensure the pump's capability to perform its design basis required functions. The team also ensured that completed tests were accomplished appropriately at an appropriate frequency. Design change history and corrective maintenance were reviewed to assess potential component degradation and impact on design margins. The team reviewed associated electrical calculations to confirm that the design basis minimum voltage at the motor terminals would be adequate for starting and running the motor under design basis conditions.

b. Findings

Two Green NCVs were identified.

1. Non-Conservative Errors in Unverified Design Input Data Used to Determine the Impact

Introduction: The team identified a NCV of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," having very low safety significance (Green) involving calculation input discrepancies in Calculation BYR2000-062/BRW-00-0111-E, Revision 0, dated April 28, 2000, "Load Changes for Large Medium Voltage Loads - Power Uprate."

Description: Calculation BYR2000-062/BRW-00-0111-E, which had been prepared by Stone & Webster Engineers & Constructors, Inc., in support of the Byron/Braidwood

Power Uprate Project, was used by the licensee as the calculation of record for the following purposes:

- Documenting the anticipated power uprate load changes, including changes in brake horsepower (BHP) or kW for all large medium voltage loads, as evaluated at the core power uprate conditions for startup, normal and LOCA conditions;

- Documenting the source reference for any evaluation that determined a BHP or kW change at power uprate conditions;

- Providing input to the licensee's electrical load management system (ELMS) load flow model, for revising the load flow analyses to reflect power uprate conditions.

The team identified that the calculation determined that the BHP values for the component cooling pumps, containment spray pumps, centrifugal charging pumps, residual heat removal pumps, and safety injection pumps had decreased, relative to the values determined in the pre-uprate revision of ELMS. In investigating the basis for a decrease in loading, the team identified that some of the values were referenced to UFSAR values, rather than to design documents. The team also determined that in some cases there was insufficient information presented or referenced in calculation Attachment C, "BHP Requirements under Core Uprate Conditions," to clearly determine the origin and correctness of the values.

To address the team's concern regarding the adequacy of the calculation, the licensee retrieved and informally reviewed the source documents further, and determined there were non-conservative errors in the mechanical design inputs to the electrical calculation. The errors included the following:

- The calculation failed to account for higher component cooling water flows that could occur following loss-of-coolant accident (LOCA) conditions;

- The calculation used non-conservative flow values from the UFSAR, which in some cases reflected degraded pump flows, rather than higher flows appropriate for determining maximum design basis loads;

- For the containment spray pumps, the calculation used values from UFSAR Section 6.5.2, which identified flow delivered to containment, and did not include additional recirculation flow for the spray additive eductor;

- The calculation failed to include gear losses for the charging pumps; and

- In some cases, the data from pump curves was not correctly translated.

The licensee also determined that it was not clear in all cases where the mechanical design input data had originated or how it had been applied in the calculation. Based on retrieval of documents in the power uprate project contract files, the licensee determined that the mechanical design inputs to the electrical calculation had not been independently verified within the licensee's contracting organization (Stone & Webster

Engineers & Constructors, Inc.). In addition, the licensee's calculation oversight review, performed May 8, 2000, had not questioned the reductions in BHP for safety-related loads or the use of UFSAR values as design inputs, and had not identified the contractor's failure to perform an independent verification of the BHP design inputs associated with the delivered calculation, as required by the power uprate project.

The licensee determined that this calculation had not been used as a design input for determining loading or fuel consumption of the emergency diesel generators (EDGs) under loss of coolant or loss of off-site power conditions, therefore the errors had no adverse impact on the EDGs. The loading and fuel consumption of the emergency diesel generators had been determined by separate calculations prepared by the licensee using independently verified design input data. Specifically, the licensee informally determined during the inspection that use of the incorrect design input data, resulted in a decrease in electrical systems margin of about 1.5 percent, but that adequate margin remained.

To address this condition, the licensee initiated AR 00556440, performed the informal analyses identified above, and plans to complete a formal independent review of the design inputs for BHP, and revise the power uprate calculation BYR2000-062/ BRW-00-0111E, based on verified BHP inputs. Using the corrected values, the licensee plans to revise the ELMS load flow model as needed to incorporate the verified values.

To address the extent of condition for other power uprate calculations performed by Stone & Webster Engineers & Constructors, Inc., during the inspection, the licensee stated they had informally evaluated all 54 of these calculations using an expert panel, and did not identify any significant discrepancies in the process or any obvious errors.

Analysis: The team determined that the licensee's failure in April and May 2000 to perform adequate reviews of design input data used in revising ELMS load flow calculations was a performance deficiency and a finding warranting a significance evaluation. The team determined that the finding was more than minor in accordance with IMC 0612, Appendix B, "Issue Dispositioning Screening," because it was associated with the attribute of design control, which affected the Mitigating Systems cornerstone objective of ensuring the availability and reliability of the engineered safety features 4160 Vac system to respond to initiating events to prevent undesirable consequences.

The team evaluated the finding using IMC 0609, Appendix A, "Significance Determination of Reactor Inspection Findings for At-Power Situations," Phase 1 screening, and determined that the finding screened as Green because it was not a design issue resulting in loss of function per Part 9900, Technical Guidance, did not represent an actual loss of a system's safety function, did not result in exceeding a TS allowed outage time, and did not affect external event mitigation.

The team did not identify a cross-cutting aspect to this finding.

Enforcement: 10 CFR Part 50, Appendix B, Criterion III, "Design Control," requires, in part, that measures shall be established to assure that applicable regulatory requirements and the design basis, as defined in § 50.2 and as specified in the license application, for those structures, systems, and components to which this appendix

applies are correctly translated into specifications, drawings, procedures, and instructions.

Contrary to the above, during this inspection, the team identified that on April 28, 2000, during the preparation of calculation BYR2000-062/BRW-00-0111-E, Revision 0 by the power uprate project contractor, and during subsequent oversight review by the licensee May 8, 2000, the contracting organization and the licensee failed to perform an adequate design review of the design input data for determining the impact of the power uprate on medium voltage loads. Specifically, the licensee's contractor failed to perform independent verification of the BHP data and the licensee failed to identify the errors during their oversight review. The results of this calculation were subsequently used to revise the ELMS load flow analysis, resulting in an incorrect and non-conservative determination of engineered safety features 4160 Vac system loading. However, because this violation was of very low safety significance and it was entered into the licensee's corrective action program, this violation is being treated as an NCV, consistent with Section VI.A.1 of the NRC Enforcement Policy (05000454/2006009-01(DRS); 05000455/2006009-01(DRS)).

2. Acceptance Criteria for Safety Injection Pump NPSH Not Met

Introduction: The team identified a NCV of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," having very low significance (Green) involving both analysis assumptions and design input in Calculation BYR04-016/BRW-04-0005-M, Revision 0/0, dated June 23, 2005, "RHR, SI, CV, and CS Pump NPSH During ECCS Injection Mode." Specifically, the calculation contained errors and failed to demonstrate that the acceptance criteria was met.

Description: The purpose of Calculation BYR04-016/BRW-04-0004-M was to confirm that adequate NPSH exists for the Emergency Core Cooling System (ECCS) pumps during the injection phase, (suction from the RWST)." The Byron RWST includes a non-safety-related vacuum breaker which introduces a potential unique failure mechanism, that of failing to open thereby allowing the tank to develop a vacuum.

The team noted that the results of the analysis, as presented, did not satisfy the Acceptance Criterion stated in the calculation. The Acceptance Criterion required that available NPSH exceed the stated required NPSH. Specifically, for one of the cases examined, the 1A SI pump was shown to have an available NPSH of 26.44 feet, whereas the required value was listed as 28 feet. The calculation included a note that qualitatively justified the negative margin. Further, the team identified three non-conservative calculation errors relating to the treatment of the tank pressure during review of this calculation:

- The initial tank pressure was assumed to be 14.7 psia: at the Byron Station elevation the atmospheric pressure is lower than this value by close to 0.5 psia.

- At the onset of ECCS out-flow the initial RWST pressure will be further reduced from the ambient atmospheric pressure somewhat, due to the continual evacuating of air by the VF HVAC system.

- The method used to correlate tank pressure with the changing gas volume assumed that the process was isothermal. As stated in the text of the calculation, however, the RWST is well-insulated and that the drain down occurs over a relatively short period of time. Hence it is expected that the governing pressure-volume relation would be closer to adiabatic that isothermal.

The above non-conservative errors, when factored into the analysis, would further decrease the available NPSH for the 1A SI pump.

To address the above concerns, the licensee initiated IR 562375, "CBDI - Calculation BYR04-016 Assumptions." The licensee undertook a preliminary evaluation of the above concerns to assess pump operability. On further review, the licensee determined that the SI pump flow assumed in the calculation was unnecessarily conservative with the result that the required NPSH associated with the lower flow was shown to be satisfied.

Analysis: The team determined that the failure to quantitatively demonstrate adequate NPSH for the SI pump was a performance deficiency warranting a significance evaluation. In addition, the identified calculation non-conservative elements led to the conclusion that BYR04-016/BRW-04-0004-M was an inadequate calculation. The team concluded that the finding was greater than minor because it was similar to example 3j of Appendix E in IMC 0612, "Power Reactor Inspection Reports." Specifically, the calculation of record contained the above identified non-conservatisms and errors, failed to quantitavely demonstrate that the Acceptance Criterion was met, and as a result, there was reasonable doubt of the successful outcome of a re-analysis. This finding affected the Mitigating System cornerstone.

The team completed a significance determination of this finding using IMC 0609, Appendix A, "Significance Determination of Reactor Inspection Findings for At - Power Situations." The team answered "no" to all five screening questions in the Phase 1 Screening Worksheet under the Mitigating Systems column. After further evaluation, the inspectors concluded that the safety injection pump would have remained operational had it been called upon, therefore, did not represent an actual loss of a safety function. The finding screened out as having very low safety significance or (Green).

This finding had a cross-cutting aspect in the area of human performance because the licensee did not ensure that the calculation results satisfied the stated Acceptance Criteria, thus failing to demonstrate that the design basis was maintained.

Enforcement: Title 10 CFR Part 50, Appendix B, Criterion III, "Design Control," requires, in part, that measures shall be established to assure that applicable regulatory requirements and the design basis are correctly translated into drawings, procedures, and instructions.

Contrary to the above, as of November 27, 2006, the licensee failed to assure that the design basis for the safety injection pump was correctly translated into drawings,

procedures, and instructions. Specifically, the results of calculation BYR04-016/ BRW-04-0004-M did not demonstrate adequate NPSH available for the SI pump to perform its design basis function. Once identified, the licensee entered the finding into their corrective action program as IR 562375. Because this violation was of very low safety significance and it was entered into the licensee's corrective action program, this violation is being treated as a NCV, consistent with Section VI.A.1 of the NRC Enforcement Policy (05000454/2006009-02(DRS); 05000455/2006009-02(DRS)).

.4 Operating Experience

a. Inspection Scope

The team reviewed five operating experience issues (5 samples) to ensure these issues, either NRC generic concerns or identified at other facilities, had been adequately evaluated and addressed by the licensee. The operating experience issues listed below were reviewed as part of this inspection effort:

- OE 22388, Cracked Push Rods, Apparent Cause;
- IN 97-90; Use of Non-Conservative Acceptance Criteria in Safety-Related Pump Surveillance Tests;
- OE 20884, Potentially Unanalyzed Scenario for SBLOCA;
- IN-2002-12, Submerged Safety-Related Electrical Cables; and
- OE 17651, Safety Injection Pump 'A' Lube Oil Cooler was Found Plugged during an Inspection.

b. Findings

No findings of significance were identified.

.5 Modifications

a. Inspection Scope

The team reviewed six permanent plant modifications related to selected risk significant components to verify that the design bases, licensing bases, and performance capability of the components have not been degraded through modifications. The modifications listed below were reviewed as part of this inspection effort:

- EC 351953 (DCP), Replace Westinghouse breaker with new Cutler-Hammer Breaker [MOV 1SX004, Unit 1 component cooling water heat exchanger 1CC01A SX supply isolation valve];
- EC 77716, AFW Suction Pressure Ld/Lg Delay Card;
- EC 360950, SX Pump Oil Cooler Replacement;

- M6-1-8-3, Reference Legs for RWST Differential Pressure;
- EC 360374, RWST Level Transmitted Common Vent; and
- EC 359550, 2A DG Pushrod Breakage Evaluation.

b. Findings

No findings of significance were identified.

.6 Risk Significant Operator Actions

a. Inspection Scope

The inspectors performed a margin assessment and detailed review of five risk significant, time critical operator actions (five samples). These actions were selected from the licensee's PRA rankings of human action importance based on risk achievement worth values. Where possible, margins were determined by the review of the assumed design basis and UFSAR response times and performance times documented by job performance measures results. For the selected operator actions, the inspectors observed both simulator and in plant walk downs of associated procedures with plant operator's to assess operator's knowledge level, adequacy of procedures, and availability of special equipment where required. The following operator actions were reviewed:

- Actions to prevent Steam Generator overfill in response to a Steam Generator Tube Rupture;
- Actions to transfer the ECCS to containment sump recirculation during a large break LOCA;
- Actions to respond to an Anticipated Transient Without Scram were observed both in the simulator and in the plant;
- Actions to deal with an Essential Service Water header break/leak inside the Auxiliary Building; and
- Actions to establish backup fire water supplies to the Centifugal Charging Pumps following a loss of Essential Service Water cooling.

b. Findings

No findings of significance were identified.

4. OTHER ACTIVITIES (OA)

4OA2 Problem Identification and Resolution

.1 Review of Condition Reports

a. Inspection Scope

The team reviewed a sample of the selected component problems that were identified by the licensee and entered into the corrective action program. The team reviewed these issues to verify an appropriate threshold for identifying issues and to evaluate the effectiveness of corrective actions related to design issues. The specific corrective action documents that were sampled and reviewed by the team are listed in the attachment to this report.

b. Findings

No findings of significance were identified.

4OA6 Meetings, Including Exits

.1 Exit Meeting Summary

The team presented the inspection results to Mr. D. Hoots and other members of licensee management at the conclusion of the inspection on December 1, 2006. Proprietary information was reviewed during the inspection and was be handled in accordance with NRC policy.

4OA7 Licensee-Identified Violations

The following violation of very low significance was identified by the licensee and is a violation of NRC requirements which meets the criteria of Section VI of the NRC Enforcement Manual, NUREG-1600, for being dispositioned as an NCV.

Cornerstone: Mitigating System

Criterion III, "Design Control," of 10 CFR Part 50, Appendix B requires, in part, that measures be established to assure that applicable regulatory requirements and the design basis, as defined in §50.2 and as specified in the license application are correctly translated into specifications, drawings, procedures, and instructions. In addition, design control measures shall be established for the selection and review for suitability of application of processes that are essential to the safety-related functions of the structures, systems and components.

During an operating experience review, the licensee questioned the design control measures established for the selection and review for suitability of application the appropriateness of the methodology used to calculate the current RWST vortex level. As a result, the licensee issued IR 00541701, "Tank Vortexing OE Review Needed,"

dated October 9, 2006, to document the concern. In addition, the licensee generated Technical Evaluation EC0000363148, "RWST Vortexing Margin Assessment, Also Applies to BWD," dated October 31, 2006, to review the various methodologies used to calculate a tank's vortex level. The results of the licensee's technical evaluation revealed that utilizing alternate methodologies, depending on which methodology was selected, the vortex level in the RWST would increase between 2.5 and 5 feet. The licensee concluded, based primarily on consideration of available margin in operator response times and the use of the most conservative vortex methodology, that adequate margin existed to prevent an adverse effect on the ECCS pumps due to air entrainment.

The licensee entered the finding into their corrective action program and plans to select the most appropriate methodology, revise the affected calculations and ensure that any other required changes are correctly translated into specifications, drawings, procedures, and instructions to support the required change in methodology. The finding was of very low safety significance because the licensee's analysis showed that adequate RWST capacity remained for the ECCS pumps and the finding did not represent an actual loss of a safety function.

ATTACHMENT: SUPPLEMENTAL INFORMATION

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee
F. Beutler, Design Engineering, Electrical
E. Blondin, Design Engineering
J. Carandang, Design Engineering, Mechanical
P. Creegan, Design Engineering, Rapid Response
T. Fluck, Regulatory Assurance
R. Hildebrand, Plant Engineering, Electrical
J. Horn, ECCS System Engineer
M. Hubbard, Electrical Design, Rapid Response
E. Kaczmarski, Design Analysis, I & C
F. Lentine, Corporate Design
T. Leaf, Operations
A. Mitchell, RHR System Engineer
J. Mois, EDG System Engineer
B. Morello, Design Engineering, Electrical
V. Naschansky, Design Engineering, Electrical
D. Neidich, Design Engineer, I & C
K. Passmore, BOP Group Lead
B. Perchiazzi, Design Engineering Manager
K. Ramsden, Corporate Design
D. Riedinger, Braidwood Electrical Design
D. Sargent, Design Engineering, Mechanical
R. Schmidt, Environmental Qualification
B. Smith, MOV Engineer, GL 89-10 Program
B. Sooby, Design Engineering, Electrical
D. Spitzer, Design Engineering
L. Wehner, Operations
B. Quigley, Design Analysis, Mechanical

NRC
B. Bartlett, Senior Resident Inspector
L. Kozak, RIII Senior Reactor Analyst
R. Ng, Resident Inspector
A. Stone, RIII Engineering Branch 1, Chief

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened and Closed

05000454/455/2006009-01	NCV	Non-Conservative Errors in Unverified Design Input Data Used to Determine the Impact of Core Power Uprate on Medium Voltage Loads (Section 1R21.3.b.1)
05000454/455/2006009-02	NCV	Acceptance Criteria for Safety Injection Pump NPSH Not Met (Section 1R21.3.b.2)

Discussed

None

LIST OF DOCUMENTS REVIEWED

The following is a list of licensee documents reviewed during the inspection, including documents prepared by others for the licensee. Inclusion on this list does not imply that NRC team reviewed the documents in their entirety, but rather that selected sections or portions of the documents were evaluated as part of the overall inspection effort. Inclusion of a document in this list does not imply NRC acceptance of the document, unless specifically stated in the inspection report.

CALCULATIONS

Number	Description or Title	Date or Revision
BRW-96-14E/ BYR-96-128	Refueling Water Storage Tank (RWST) Level Alarm Bi-Stables and Level Indicator Accuracy	1
BYR-97-273/ BRW-97-0625-1	Condensate Storage Tank Level Error Analysis	0
SITH-1	Refueling Water Storage Tank (RWST) Level Setpoints	6
90-0094	Essential Service Water System Station Blackout Analysis	0
91-0080	Service Water Model Calibration	2
91-0121	Cooling Tower Flows for UHS Analysis	10/04/91
95-044	Thermal Endurance Evaluation of CV and SX Pumps	05/11/95
ATD-0024	SX System Alignment Variations for a Single-Unit LOCA	0
BYR03-115	SX Pump Lube Oil Cooler Allowable Tube Blockage	0
BYR03-122	Documentation of Basis for Minimum Fuel Quantity in AF Pump Diesel Oil Day Tank	0
BYR04-043	Documentation of Adequate NPSHa for AF Pumps When Supplied from CSTs	1
BYR96-259	SX System FLO-SERIES Analysis	0
BYR96-281	Determination of SXCT Bypass Valve Leakage	3

CALCULATIONS

Number	Description or Title	Date or Revision
BYR97-158	SX Water Temperature Rise Due to Pump Heat	0
CN-FSE-00-2	Byron/Braidwood Unit 1 Auxiliary Feedwater Storage Volume for Uprating to 3600 Mwt NSSS Power	1
DIT-0002-02	Transmittal of Calculation for UHS Accident Scenario Descriptions	2
DIT-BRW-2002-0033	Design Input for Revision of Byron Diesel Generator Loading Calculation 19-T05, Braidwood Diesel Loading Calculation 19-T-6 and Byron/Braidwood Diesel Generator Fuel Oil Consumption Calculation DGDO9301	10/15/02
MAD 91-0142	Cooling Tower Flows for UHS Cool Weather Analysis	1
NDIT BYR-95-040	Byron CV & SX Pump Room Cubicle Cooler Reanalysis Design Inputs	05/05/95
NDIT BRW-95-017	Transmittal of Braidwood CV and SX Pump Rooms Heatup Analysis Utilizing Westinghouse COMPACT Model	05/10/95
PSA-B-97-18	Byron/Braidwood AFW Flow for AF005A-H Modification	5A
PSAG-138	Available NPSH for a Pump when Supplied from SX System	0
PSAG-39	Aux Feed Pump Diesel Intake Plenum Suction Pressure	0
RSA-B-90-06	Byron/Braidwood Containment Response During Station Blackout	2
SX1-89	Available NPSH for AF Pump when Supplied from SX System	1
SX2-76	SX Pump Head Check	4
UHS-04 Attachment A	Estimation of the Essential Service Water Cooling Tower Riser Valve Leakage	11/18/96
VA-100	ESF Pump Cubicle Energy Calculation	5

CALCULATIONS

Number	Description or Title	Date or Revision
19-AQ-63	Division Specific Degraded Voltage Analysis	6
19-AQ-72	125 Vdc Voltage Drop Calculation	5
19-T-05	Diesel Generator Loading During LOOP/LOCA - Byron Units 1 and 2	5
AD-02	Calculation for Determination of Potential Transformer Accuracy at 4.16 kV ESF Switchgear	0
AK-04	ELMS-AC Plus Project Specific Implementation	2
AN-28	Calculation for Second-level Undervoltage Relay Setpoint	1
BYR-01-084	Generic Thermal Overload Heater Sizing Calculations for MOVs	0
BYR-01-093	Motor Operated Valves (MOV) Actuator Motor terminal Voltage and Thermal Overload Sizing Calculation -Containment Spray System	1
BYR-01-094	Motor Operated Valves (MOV) Actuator Motor terminal Voltage and Thermal Overload Sizing Calculation - Safety Injection System	1
BYR 01-095	Motor Operated Valves (MOV) Actuator Motor terminal Voltage and Thermal Overload Sizing Calculation - Essential Service Water System	1A
BYR 2000-062	Byron and Braidwood Uprate Project - Load Changes for Large Medium Voltage Loads - Power Uprate	0
BYR 2000-191	Voltage Drop Calculation for 480 V Switchgear Breaker Control Circuits [Bus 131Z, pp. 59 to 76, Bus 132Z, pp. 123 - 140]	0
BYR 97-193	Battery Duty Cycle and Sizing for the Byron Diesel Driven Auxiliary Feedwater Pumps and the Byron Diesel Driven Essential Service Water Makeup Pumps	1

CALCULATIONS

Number	Description or Title	Date or Revision
BYR 97-204	125 VDC Battery Sizing Calculation	3
BYR 97-205	125 Vdc Battery Charger Sizing Calculation	2
BYR 97-224	125 Vdc Voltage Drop Calculation	2
BYR 97-225	Circuit Breaker Trip Settings - 125V DC and 250V DC Distribution Centers	1
BYR 97-227	125 Vdc Fuse Sizing and Coordination	0
NED-M-MSD-136	Appropriate Current and Power Factor to Calculate Terminal Voltage for AC MOV Motors	0
T-03	Station Blackout - Diesel Generator Loading	1
VA-102	Auxiliary Building Energy Load Calculation for Elevation 330', 346', 364', 383', 401', 426' in Abnormal Condition [limited to interface review for environmental conditions]	0
19-AN-07	Protective Relay Settings for 4.16 kV ESF Switchgear	11
19-AQ-43	Review of Circuit Lengths for 4kV Switchgear Breaker Control	2
19-AQ-61	Voltage Drop in Breaker Closing Control Circuits for Various 4.16 kV and 480 V Loads	0
CN-FSE-00-4	Cooldown for Uprating	1
EDRE-AEE-00-47	Byron/Braidwood Uprating NSSS Auxiliary Equipment Report for Tanks, Heat Exchangers. Pumps and Valves	0
DD-RH-030382	RHR Orifice Plate Sizing for Flow Limiting on RHR Pump Recirculation	1
BYR06-058	NPSHA for RHR and CS Pumps during Post-LOCA Recirculation	0
BYR 97-191	Containment Spray Hydraulic Model	2

CALCULATIONS

Number	Description or Title	Date or Revision
PSA-B-97-13	Evaluation of CST Vortices for Byron and Braidwood Stations	1
3C8-0691-002	Diesel Generator Room Temperature Transient Following Turbine Building HELB	1
CWS-CAE-446C	Emergency Operating Instructions, (RHR Recirculation Flow Heatup)	01/03/84
JP-95-263	Verify the Adequacy of the Available Suction Head for the Engine Driven Jacket Cooling Water Pump and the Jacket Water Circulating Pump for the Emergency Diesel Generators	1
DGDO9301	Time Dependent Loading and Fuel Consumption for EDGs Following LOOP/LOCA	6
BYR 98-211	Residual Heat Removal (RHR) ECCS Pump Flow and Pressure Accuracy Evaluation	0
VD-103	Bounding VD Room Temperature Based on Capacity Verification and Pre-Op Tests	0
VD-100	Diesel Generator Room Energy Loads	0
BYR04-055	Determination of Tube Plugging Limits for DG Jacket Water Coolers	0
BYR99-026	Determination of the Burst Pressure for the Diesel Generator Exhaust Stack Rupture Disk	1
V-EC-1678	Byron/Braidwood RHR HX Evaluation Followup	0
TE-EC-077	Increase in Flow Rate Through the Byron and Braidwood Residual Heat Removal Heat Exchangers	1
BYR2000-014	Byron/Braidwood Uprate Project - Post LOCA Component Cooling Water System Temperature Analysis	1
CC-95	GL 89-13 Test Results for the Component Cooling Water Heat Exchanger, 1CC01A	0

CALCULATIONS

Number	Description or Title	Date or Revision
BYR97-467	Component Cooling Heat Exchanger Tube Plugging Evaluation	3
BYR2000-014	Byron/Braidwood Uprate Project - Post LOCA Component Cooling Water Temperature Analysis	1
BYR2000-014	Byron/Braidwood Uprate Project - Post LOCA Component Cooling Water System Temperature Analysis	1
BYR06-029/BRW-06-0016-M	SI/RHR/CS/CV SYSTEM HYDRAULIC ANALYSIS IN SUPPORT OF GSI-191	0
CN-FSE-00-4	Cooldown for Uprating	1
BYR05-098	NPSH for RHR Pumps During RC System Mid-Loop Operation	0
BYR04-016/BRW-04-0005-M	RHR, SI, CV, and CS Pump NPSH During ECCS Injection Mode	0
BYR98-207	Validation of Residual Decay Heat Input fro the FSAR RHR Cooldown Curves	00
BYR97-223	Heat Dissipated by Electrical Equipment in the Miscellaneous Electrical Equipment and Batter Rooms	2
BYR97-467	Component Cooling Heat Exchanger Tube Plugging Evaluation	3
DGDO9301	Time Dependent Loading and Fuel Consumption for EDGs Following LOOP/LOCA	5
19-T-5	Diesel Generator Loading During LOOP/LOCA - Byron Units 1 and 2	5
BYR 98-223	ECCS Flow Accuracy Evaluation	2
ATD-0196	Useable Volume in Diesel Oil Storage Tanks and Day Tanks	3
BYR 95-068	Seismic Qualification of 3/4" 3000# Socket Welded Connection to the Bonnet of Valves 1/2SI8811A/B	0

CALCULATIONS

Number	Description or Title	Date or Revision
NED-M-MSD-128	2SI8811A/B Operator Mounting Bolts Material Change to A-193, Gr B7	2
BYR 97-386	Safety Injection MOC Differential Pressure	1
CE-BB-013	MOV Allowable Stem and Disc Thrust	0
BYR 96-237	Estimate the Required Closing Thrust which Will Not Allow the SI 8811 Valve Disc to Unseat with a dp of 50 psi	0
BYR 97-249	Verification of Capability for Byron 24" 1(2) SI8811 A and B Valves Susceptible to Pressure Locking	0
BYR 1SI8811A/B	AC Motor Operated Gate Valve Calculation	2
BYR 98-237	Weak Link Analysis of MOV 1(2)CS001A(B)	0
002-M-011	Byron Unit 2 Containment Spray Operating Conditions	2
BYR 04-016	RHR, SI, CV, and CS Pump NPSH During ECCS Injection Mode	0

CORRECTIVE ACTION PROGRAM DOCUMENTS

Number	Description or Title	Date or Revision
00557664	NRC CDBI Audit, Incorrect Wording Found in Calc	11/14/06
00558322	Drawing M-904-1 Should Have Been Superseded by Vendor Dwgs	11/15/06
00562329	NRC CDBI Audit, RWST Level Transmitter Elevations	11/27/06
00563506	CDBI - Design Vulnerability with 1/2SI8969F Check Valve	11/30/06
00541701	Tank Vortexing OE Review Needed	10/9/06
AR 00233999	Westinghouse TB 04-13: Molded Case Circuit Breaker Issues	7/6/04
AR 00239679	ACB 1413 Failed to Close	7/28/04

CORRECTIVE ACTION PROGRAM DOCUMENTS

Number	Description or Title	Date or Revision
AR 00296138	Unexpected Alarms	1/31/05
AR 00308078	1A AF Pump B Phase Overcurrent Relay Found OOT	3/3/05
AR 00359168	Battery Charger 212 Voltage Fluctuations	8/2/05
AR 00429419	Momentary DC Bus 212 Ground	12/1/05
AR 00431557	Replace Sample Tube Caps and Repair Broken Sample Tubes	12/7/05
AR 00436037	1A D/G Large Swings in VARs During Monthly Surveillance	12/21/05
AR 00437579	212 ESF Battery Cell 20 Sample Cap is Broken	12/30/05
AR 00438533	Momentary Alarm on 112 Battery Charger (1DC04E)	1/4/06
AR 00438729	Circuit Card Cat ID 483262-4 Has R11 Resistor Installed	1/4/06
AR 00438937	Battery Surveillance Questions - Operability Concern	1/5/06
AR 00449458	FME in 212 Battery, Cell 20	2/3/06
AR 00473083	DC Bus 112 Charger Trouble Alarm	3/31/06
AR 00477971	Unexpected 125 Vdc Battery Charger 112 Trouble Alarm	4/12/06
AR 00506785	130 Volt Negative Ground on DC Bus 112	7/6/06
AR 00509274	10 CFR Part 21 for Battery Chargers	7/14/06
AR 00518576	Battery Volts 128 Trending Down	8/10/06
AR 00521875	DC Bus 211 Voltage Fluctuations	8/21/06
AR 00525062	Received Unexpected Ground Alarm on DC Bus 111	8/29/06
AR 00530111	DC 11 Ground in During Partial Clear of 1PA23J Relay Circuit	9/12/06
AR 00534980	DC 112 Grounds	9/22/06

CORRECTIVE ACTION PROGRAM DOCUMENTS

Number	Description or Title	Date or Revision
AR 00535019	Battery Charger 111 Tripped During Battery Recharge	9/23/06
AR 00546831	Battery Connection Resistance	10/20/06
IR 00212886	Heater Full on in Bus 241 Cubicle	4/3/04
IR 00325280	USS Transformer Making Abnormal Vibrating Noises	4/15/05
IR 00328721	86 Lockout Relay for ACB 2412 Melted During OAD Relay Tests	4/26/05
IR 00328839	Lockout Relay Failure Causes Equipment Availability Concern	4/26/05
IR 00330559	Relay out of Tolerance	4/30/05
IR 00492803	Bus 241 Degraded Voltage Relay Target Did Not Actuate	5/23/06
IR 00514007	2A CS PP Breaker Inspection Identified Loose Basket Finger	7/27/06
AR 00550659	Bus 241 4kV Breaker PM Schedule for Feeder Breakers to 480 V ESF Switchgear Buses 231X, 231Z Were 6-Year Frequency Rather than 3 Years as Stipulated by the PCM Template.	10/29/06
AR 00556440	Problems with Calculation BYR2000-062/BRW-00-0111-E, Load Changes for Large Medium Voltage Loads for Power Uprate	11/10/06
IR 00563012	Calibration of Degraded Voltage Relays for 4kV ESF Buses [no written procedural controls for selection of 5/sec scan rate as assumed in uncertainty calculation]	11/29/06
IR 00563506	CDBI - Design Vulnerability with 1/2 SI8969F Check Valve [single failure of check valve in low-pressure reference leg common to four redundant RWST differential pressure level transmitters]	11/30/06
IR 558777	CBDI - Review Required for Time Req to Valve In CC To RHR HX-55	11/16/06
IR 561369	Calculation 3C8-0691-002 Unverified Assumption	11/22/06

CORRECTIVE ACTION PROGRAM DOCUMENTS

Number	Description or Title	Date or Revision
IR 562349	CBDI - Calculation CC-95	11/27/06
IR 562375	CBDI - Calculation BYR04-016 Assumptions	11/27/06
IR 563506	CBDI - Design Vulnerability with 1/2SI8969 Check Valve	11/30/06
IR 567934	CBDI - Documentation Weakness Motor Driven Auxiliary Feedwater Pump Lead/Lag Card Modification	12/11/06
AR 0183227	Results of 2003 Design Calculation FASA	10/28/03
AR 0544821	Water Solid RH during SBLOCA	10/16/06
IR 505157	Documentation Discrepancy during Execution of 2BVSR 5.2.4-3	6/29/06
AR 541701	Tank Vortexing OE Review Needed	10/9/06
AR 456315	2A DG Broken Push Rod	2/20/06
AR 456438	2A DG, Push Rod 7L, 9L	2/21/06
AR 239280	RWST Vent/Vacuum Breaker Design Basis Issues	7/27/04
AR 183227	Results of 2003 Design Calculation FASA	10/28/03
AR 175227	Potential Enhancements to Westinghouse	9/10/03
AR 301744	Design of RWST Vacuum Relief System	2/15/05
AR 253061	Unplanned LCOAR Entry for 2A SX Pp, Seal Supply Line Failure	9/15/04
AR 253321	1A/1B/2B SX Pumps Seal Cooling Water Piping	9/15/04
AR 342146	Valve 1SX169A Stroke Time Acceptable but Slightly Off Trend	6/8/05
AR 366895	Some Ref. of Calc 90-0094 Are Not Presently Retrievable	8/25/05
AR 474962	Difficulty in Obtaining 2B Sx Pp ASME Set Criteria for Surv	4/4/06
IR 381151	MOV 2SI8811B Low on Grease/Potential Cracked Rotors	10/3/05

CORRECTIVE ACTION PROGRAM DOCUMENTS

Number	Description or Title	Date or Revision
AR 533911	EOC Due to Discovery of Gas Void in RWST Discharge Line	9/16/06
AR 534770	ECCS Tech Spec Venting Surveillance May Not Be Comprehensive	9/22/06
CR 183227	Results of Design Calculation FASA	10/28/03

DESIGN CHANGE PACKAGES

Number	Description or Title	Date or Revision
9400176	U1 RWST Setpoint/Scaling Change Request 94-034	8/15/94
9400178	U1 RWST Setpoint/Scaling Change Request 94-035	8/15/94
9400179	U1 RWST Setpoint/Scaling Change Request 94-036	8/15/94
9400182	U1 RWST Setpoint/Scaling Change Request 94-037	8/15/94
9400382	U2 RWST Setpoint/Scaling Change Request 94-059 (i.e., Reference 16 in Calculation SITH-1)	6/8/95
9400384	U2 RWST Setpoint/Scaling Change Request 94-060 (i.e., Reference 17 in Calculation SITH-1)	5/12/95
9400385	U2 RWST Setpoint/Scaling Change Request 94-061 (i.e., Reference 18 in Calculation SITH-1)	5/12/95
9400386	U2 RWST Setpoint/Scaling Change Request 94-062 (i.e., Reference 19 in Calculation SITH-1)	6/8/95

DRAWINGS

Number	Description or Title	Date or Revision
6E-1-4030AF01	Schematic Diagram Auxiliary Feedwater Pump 1A - 1AF01PA	AB
6E-1-4030AF02	Schematic Diagram Auxiliary Feedwater Pump 1B (Diesel Driven) - 1AF01PB	AA
6E-1-4030AF12	Schematic Diagram Auxiliary Feedwater Pump 1B (Diesel Driven) - 1AF01PB	AD

DRAWINGS

Number	Description or Title	Date or Revision
6E-1-4030CS03	Schematic Diagram Containment Spray Pumps 1A & 1B Suction Valves - 1CS001 A and B	F
6E-1-4030SI14	Schematic Diagram Containment Sumps 1A and 1B Isolation Valves - 1SI8811A/B	P
6E-1-4030SX01	Schematic Diagram Essential Service Water Pump 1A - 1SX01PA	V
6E-1-4030SX02	Schematic Diagram Essential Service Water Pump 1B - 1SX01PB	V
6E-1-4031AF13	Loop Schematic Diagram Auxiliary Feedwater Pump Suction Pressure Cab 1PA33J	D
6E-1-4031AF14	Loop Schematic Diagram Auxiliary Feedwater Pump Suction Pressure Cab 1PA34J	C
M-61, Sheet 1B	Diagram of Safety Injection	AV
M-835, Sheet 3 of 6	Instrument Locations; Elevation 379' - 6"; Refueling Water Pipe Tunnel; Byron Station Units 1 and 2	E
P-SI-2266, Sheet 1	Safety Injection	A
P-SI-2266, Sheet 2	Safety Injection	A
P-SI-2267	Small Bore Isometric Safety Injection - SI	3
S-1402	Refueling Water Storage Tank Foundation Plan	J
S-1404	Refueling Water Storage Tank Sections and Details	T
SI-44	Safety Injection	4
SI-45	Safety Injection	8/18/84
1663D96	(Westinghouse drawing) AC Motor - Frame 8009555 - Type LLD Horizontal - Plit Sleeve Bearings - Drip Proof	0
6E-1-4001A	Station One Line Diagram	N
6E-2-4001A	Station One Line Diagram	N
6E-2-4018A	Relaying and Metering Diagram 4160V ESF Switchgear Bus 241	M

DRAWINGS

Number	Description or Title	Date or Revision
6E-2-4030AP30	Schematic Diagram 4160V ESF Switchgear Bus 241 Undervoltage Relays PR31A-427-B241 and PR31C-427-B241, PR11A-427-ST21 and PR11C-427-ST21	S
M-37	Diagram of Auxiliary Feedwater	AW
M-42	Diagram of Esential Service Water	AD
M-122	Diagram of Auxiliary Feedwater	AW
M-126	Diagram of Essential Service Water	AY

ENGINEERING CHANGES

Number	Description or Title	Date or Revision
EC 360374	RWST Level Transmitters: Add Valves to Common Vent Header	0 and 1
EC 363148	RWST Vortexing Margin Assessment, also Applies to BWD	10/31/06
EC 360950	U-1 SX Pumps Oil Coolers Replacement	9/17/06
EC 363148	RWST Vortexing Margin Assessment	10/30/06
EC 359550	2A DG Pushrod Breakage Evaluation	2/23/06
EC-334668	Change Load Breaker Magnetic Trip Setting for Valve 1SX007 for Enhanced Reliability Considering any MOV Motor Reversal	1
EC-351953	Replace Westinghouse Breaker with New Cutler-Hammer Breaker [SX MOV U1 CC HX 1CC01A SX supply Isol Valve]	0
EC-352035	Request Engineering to Supply New Trip Settings Based on Differences between Cutler Hammer and Westinghouse Breakers for 1SX01FB	0

MODIFICATIONS

Number	Description or Title	Date or Revision
M6-1-88-083	Connect RWST D/P Level Transmitter's Reference Leg to RWST Air Space via Overflow Line	7/24/90
M6-2-88-083	Connect RWST D/P Level Transmitter's Reference Leg to RWST Air Space via Overflow Line	12/6/90

PROCEDURES

Number	Description or Title	Date or Revision
MA-AA-IM-2-00201	Essential Service Water Pump1B Suction Low Pressure Switch (SX)	7/10/00
MA-BY-722-003	Annual Inspection and Testing of 4 kV and 6.9 kV Motors	0
MA-BY-723-330	Electrical Testing of AC Motors Using Baker Instrument Advanced Winding Analyzer	0
1BOSR 8.1.2.1	Unit 1, 1A Diesel Generator Operability Surveillance	18
BOP RH-5	RH System Startup for Recirculation	22
1BCA-0.0	Loss of all AC Power	105
1BOSR SX-M1	1A AF Pump SX Suction Line Monthly Flushing Surveillance	4
BOP SX-9	Switching a Standby Essential Service Water Pump with an Operating Essential Service Water Pump	13
1BEP-3	Steam Generator Tube Rupture Unit 1	104 WOG-1C
1BEP ES-1.3	Transfer to Cold Leg Recirculation Unit 1	104 WOG-1C
1BOA PRI-7	Essential Service Water Malfunction Unit 1	103
1BFR-S.1	Response To Nuclear Power Generation / ATWS Unit 1	102 WOG-1C

REFERENCES

Number	Description or Title	Date or Revision
FASA 431070	Readiness Review for 2006 CDBI	2006

REFERENCES

Number	Description or Title	Date or Revision
EC IR# 562329	Walkdown Observation Record for RWST Level Transmitter Elevations	11/28/06
EQ-BB-047	EQ Binder: Borg-Warner Valves	04D
EQ-BB-049	EQ Binder: Anchor-Darling CS System Gate Valves	02A
EQ-BB-084	EQ Binder: Limitorque Electric MOV Actuator	03D
F-2891	[Specification] Diesel Engine/Gear Drives for Safety Related Pumps, Byron Station Units 1 and 2, Section 301.18.a	6/27/83
TID E/I&C-02	Thermal Overload Relay Element Selection for MOVs	0
DIT-BB-EPED-0178-01	ITE-27N Undervoltage Relay and Potential Transformer Data	6/5/92
Trentec Report No. 4T226.0	Material Identification Report for a Cutler Hammer Thermal Overload Relay, P/N FT11P-2.4	8/31/04
Trentec Report No. 4Q032.0	Environmental Aging Qualification Report for Cutler Hammer Thermal Overload Relays, P/N FT11P-2.4	12/29/05
IM-300	United Electric Controls Co, 300 Series Pressure Controllers, Installation and Maintenance Instructions	E
F-2891	[Specification] Diesel Engine/Gear Drives for Safety Related Pumps, Byron Station Units 1 and 2, Section 301.18.a	6/27/83
TID E/I&C-02	Thermal Overload Relay Element Selection for MOVs	0
DIT-BB-EPED-0178-01	ITE-27N Undervoltage Relay and Potential Transformer Data	6/5/92
Trentec Report No. 4T226.0	Material Identification Report for a Cutler Hammer Thermal Overload Relay, P/N FT11P-2.4	8/31/04
Trentec Report No. 4Q032.0	Environmental Aging Qualification Report for Cutler Hammer Thermal Overload Relays, P/N FT11P-2.4	12/29/05

SURVEILLANCES

Number	Description or Title	Date or Revision
99217543-01	Bus 141 Tech Spec Undervoltage Relay PR 43A/C Surveillance	3/20/02
99277938-01	Bus 141 Tech Spec Undervoltage Relay PR 40A/C Surveillance	9/21/02
00550792-01	Bus 141 Tech Spec Undervoltage Relay PR 40A/C Surveillance	4/3/04
00624159-01	Bus 141 Tech Spec Undervoltage Relay PR 43A/C Surveillance	3/4/05
00686047-01	Bus 141 Tech Spec Undervoltage Relay PR 40A/C Surveillance	9/29/05
007980002-01	Bus 141 Tech Spec Undervoltage Relay PR 43A/C Surveillance	9/20/06
00498700-01	MOV 1SI8811A Thermal Overload Surveillance/ Inspection	9/28/03
99170849-01	MOV 1SI8811B Thermal Overload Surveillance/ Inspection	3/18/02
00536766-01	MOV 2SI8811A Thermal Overload Surveillance/ Inspection	3/31/04
990133912-01	MOV 2SI8811B Thermal Overload Surveillance/ Inspection	4/15/01
00460404-01	MOV 1CS001A Thermal Overload Surveillance/ Inspection	1/22/04
98023724-01	MOV 1CS001B Thermal Overload Surveillance/ Inspection	6/3/04
99265540-01	MOV 2CS001A Thermal Overload Surveillance/ Inspection	4/30/03
00782680-01	MOV 2CS001B Thermal Overload Surveillance/ Inspection	2/18/06
990110618-01	PM on Breaker - Bus 241 Feed to Transformer 231Z	3/27/01
00491252-01	PM on Breaker - AFW Pump 2A	3/27/04
00499518-01	PM on Breaker - Bus 241 Bus Tie to Bus 141	4/2/04

SURVEILLANCES

Number	Description or Title	Date or Revision
00500915-01	PM on Breaker - Component Cooling Pump 2A	4/26/04
00578062-01	PM on Breaker - SX Pump 2A	9/15/04
00750887-01	PM on Breaker - System aux Transformer Feed to Bus 241	4/26/05
00567276-01	PM on Breaker - Bus 241 Tie to 243	4/29/05
00673328-01	PM on Breaker - RHR Pump 2A	7/6/05
00604687-01	PM on Breaker - DG 2A Feed to Bus 241	9/29/05
00417002-01	Perform 5-Year Inspection per MA-BY-722-003 - 2B SX Pump Motor	10/13/04
00572892-01	Change/Sample Motor Bearing Lubricant - 2B SX Pump Motor	3/2/04
00574559-01	Change/Sample Motor Bearing Lubricant - 1B SX Pump Motor	1/11/05
00602193-01	Perform 5-Year Inspection per MA-BY-722-003 - 1B SX Pump Motor	1/13/05
00604159-01	Perform Periodic Inspection per MA-BY-722-003 - 2A SX Pump Motor	9/16/04
00663175-01	Perform Motor Inspection per MA-BY-723-330 - 1A SX Pump Motor	2/23/05
00779000-01	Change/Sample Motor Bearing Lubricant - 1A SX Pump Motor	3/22/06
00792513-01	Clean, Inspect, and Tighten Connections in Transformer 132X	9/15/06
00789840-01	Station Battery Surveillance 18-Month	9/21/06
00789563-01	111 ‘A’ Train 125V Battery Bank Service Test	9/23/06
00793222-01	125V Battery 111 - Battery Inspection for Discharge Test	9/24/06
00817111-01	125V Battery Charger 111 Inspection	11/14/06
00817472-01	111 ‘A’ Train 125V Battery Charger Operability Test	11/15/06

SURVEILLANCES

Number	Description or Title	Date or Revision
00815812-01	Perform Charger Alarm Checks on DSLV, DSHV, and Bus UV Section 4	11/15/06
00422207-01	Charger 111 Feeder Breaker to Battery 111 - Perform Molded Case Circuit Breaker Replacement	9/21/06
00422207-02	Charger 111 Feeder Breaker to Battery 111 - Bench Test New Replacement Molded Case Breaker	7/31/06
00422803-01	Perform Inspection and Testing of 111 Battery Bus Breaker - 125 Vdc Feed from Battery 111 - 1DC01E	10/1/03
00433964-01	Cycle DC Bus 111 Front Breakers	10/21/03
00433965-01	Cycle DC Bus 111 Rear Breakers	10/21/03
00680536-03	Test/Replace Molded Case Circuit Breakers - Battery Input Breaker to Inverter 111	9/22/06
00554211-01	Cable Vault Submerged Safety-Related Cable Inspection	8/29/03
00614088-01	Cable Vault Submerged Safety-Related Cable Inspection	8/26/04
00730747-01	Cable Vault Submerged Safety-Related Cable Inspection	9/9/05
00846809-01	Cable Vault Submerged Safety-Related Cable Inspection	11/2/06
1BVSR 5.2.4-4	U1 ASME Surveillance Requirements for Residual Heat Removal Pump 1RH01PB	2/1/06
2BVSR 5.2.4-4	U2 ASME Surveillance Requirements for Residual Heat Removal Pump 2RH01PB	5/3/06
2BVSR 5.2.4-4	U2 ASME Surveillance Requirements for Residual Heat Removal Pump 2RH01PA	6/30/06
1BVSR 5.5.8.RH.5-1a	Unit 1 Group A Testing (IST) Requirements for Residual Heat Removal Pump 1RH01PA	8/23/06
2BVSR 5.5.8.RH.5-2a	Unit 2 Group A Testing (IST) Requirements for Residual Heat Removal Pump 2RH01PB	8/9/06

SURVEILLANCES

Number	Description or Title	Date or Revision
2BVSR 5.5.8.RH.5-1a	Unit 2 Group A Testing (IST) Requirements for Residual Heat Removal Pump 2RH01PA	9/29/06
1BVSR 5.5.8.RH.5-2a	Unit 1 Group A Testing (IST) Requirements for Residual Heat Removal Pump 1RH01PB	8/2/06
1BVSR 5.2.4-3	Unit 1 Group A Testing (IST) Requirements for Residual Heat Removal Pump 1RH01PA	5/26/06
1BVSR 5.5.8.CC.5-1a	Unit 1 Group A Testing (IST) Requirements for Component Cooling Pump 1CC01PA	8/24/06
1BVSR 5.5.8.CC.5-2a	Unit 1 Group A Testing (IST) Requirements for Component Cooling Pump 1CC01PB	9/5/06
1BVSR 5.5.8.CC.1-2	U1 ASME Surveillance Requirements for Component Cooling Pump 1CC01PB	6/6/06
0BVSR 5.5.8.CC.5-1a	Unit 0 Group A Testing (IST) Requirements for Component Cooling Pump 0CC01PB	10/17/06
0BVSR 5.5.8.CC.1-1	U0 ASME Surveillance Requirements for Component Cooling Pump 0CC01PB	4/18/06
1BVS SX-11	Heat Transfer Test for Component Cooling Water Heat Exchangers, 1CC01A	10/8/94
0BVSR SX-9	Heat Transfer Test for Component Cooling Water Heat Exchangers, 0CC01A	3/4/06
2BOSR 8.1.9-1	2A Diesel Generator Safe S/D Sequence and Single Load Reject	10/1/05
2BOSR 8.1.9-2	2B Diesel Generator Safe S/D Sequence and Single Load Reject	10/8/05
2BOSR 8.1.11-2	2B Diesel Generator Sequencer Test	10/8/05
1BOSR 8.1.9-2	1B Diesel Generator Safe S/D Sequence and Single Load Reject	9/19/06
1BOSR 8.1.11-2	1B Diesel Generator Sequencer Test	1/19/06
894820	1A SX Pump ASME Surveillance	5/5/06

LIST OF ACRONYMS USED

ADAMS	Agency-Wide Document Access and Management System
AFW	Auxiliary Feedwater
ASME	American Society of Mechanical Engineers
CCW	Component Cooling Water
CFR	Code of Federal Regulations
CS	Containment Spray
CST	Condensate Storage Tank
CV	Chemical Volume
DRP	Division of Reactor Projects
DRS	Division of Reactor Safety
EC	Engineering Change
ECCS	Emergency Core Cooling System
EDG	Emergency Diesel Generator
EQ	Environmental or Equipment Qualification
FASA	Functional Area Self-Assessment
HELB	High Energy Line Break
HX	Heat Exchanger
IMC	Inspection Manual Chapter
IPEEE	Individual Plant Examination of External Events
IST	Inservice Testing
NCV	Non-Cited Violation
NPSH	Net Positive Suction Head
NRC	U. S. Nuclear Regulatory Commission
NRR	Office of Nuclear Reactor Regulation
PARS	Publicly Available Records
Pp	Pump
RHR	Residual Heat Removal
RWST	Refueling Water Storage Tank
SDP	Significance Determination Process
SI	Safety Injection
UFSAR	Updated Final Safety Analysis Report
UHS	Ultimate Heat Sink